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(56) Documents Cited

**WPI Accession No 92-205169/25 & JP4135808 A WPI  
Accession No 92-205168/25 & JP4135807 A WPI  
Accession No 88-037183/06 & DE3625709 A**

(58) Field of Search

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(54) **Mould having good releasability**

(57) Disclosed is a mold having excellent releasability when molding a golf ball, especially a core of a golf ball or an ionomer covered golf ball body. The mold comprises a mold body and a tungsten carbide layer in the range of from 2 to 20  $\mu$ m on the inner surface of the mold body.

**GB 2 284 175 A**

## MOLD HAVING GOOD RELEASABILITY

The present invention relates to a mold having good releasability, especially showing excellent releasability when molding a golf ball.

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Hitherto, there have been production problems when molding rubber articles or plastic articles, especially ~~poor releasability following molding~~ golf ball bodies or cores of golf balls. These problems are more serious when golf balls having ionomer covers or cores of golf balls using as a crosslinking agent a metal salt of an  $\alpha,\beta$ -unsaturated carboxylic acid are produced by molding.

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In order to improve the problems of releasability, an aqueous fluorine-containing releasing agent or a fluorine-containing resin has been applied to a mold. The aqueous fluorine-containing releasing agent, however, stains the mold badly and it takes time to clean the stains. It also takes time to apply the agent to the mold. The fluorine-containing coating has improved the annoying cleaning and applying processes, but peeling of the coating generally begins from contact surface between an upper mold and a lower mold, which makes it difficult to use the mold after about 20 times.

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A baking type silicone releasing agent which has higher releasability is also used for a mold which is used for ionomer resin covered golf balls (e.g. a so called two-piece golf ball or an ionomer covered thread wound golf ball), since the ionomer resin has good affinity to mold metal. Even this silicone releasing agent coating, however, is slightly taken away by the ionomer resin when molding. The releasing ability manages to continue at most for about 20 molding processes, but does not continue more times, similar to the

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fluorine-containing resin.

5 The present invention provides a mold having excellent releasability when molding a golf ball, especially a core of a golf ball or an ionomer covered golf ball body. The mold of the present invention comprises a mold body and a tungsten carbide layer in the range of from 2 to 20  $\mu\text{m}$  on the inner surface of said mold body.

10 The tungsten carbide is generally expressed by a chemical formula as  $\text{W}_2\text{C}$  which is formed on the mold, for example by reacting tungsten fluoride with benzene in a hydrogen gas atmosphere in which the mold is contained. The reaction formula is considered to be as follow.



15 The reaction of forming the tungsten carbide may preferably be carried out at a temperature of 350 to 550  $^\circ\text{C}$  for 0.5 to 2 hours.

The tungsten carbide on the mold has a thickness in the range of from 2 to 20  $\mu\text{m}$ , preferably 8 to 15  $\mu\text{m}$ . Thickness of less than 2  $\mu\text{m}$  is poor in uniformity of the coating surface, and more than 20  $\mu\text{m}$  may easily result in peeling of the tungsten carbide coating.

20 The mold to be coated with tungsten carbide can be anyone which is used for molding rubber articles or plastic articles. The mold is preferably formed from stainless steel, aluminum, copper or the like which is generally used for molding a core of a golf ball or an ionomer resin covered golf ball.

25 The mold which is coated with tungsten carbide, used in the present invention, has excellent releasability, which is suitable for molding, especially golf balls.

#### EXAMPLES

The present invention is illustrated by the following Examples which, however, are not to be construed as limiting the present invention to their details.

Example

5      Molding of a one piece golf ball

The following ingredients were mixed and molded in a mold for one piece golf balls at a temperature of 175 °C for 20 minutes to form a one piece golf ball.

	<u>Ingredients</u>	<u>% by weight</u>
10	Butadiene rubber	100
	Zinc oxide	23
	Methacrylic acid	21
	Antioxidant	0.5
	Dicumyl peroxide	1.5

15      Molding of a core of a two piece golf ball

The following ingredients were mixed and molded in a mold for core of two piece golf balls at a temperature of 150 °C for 25 minutes to form a two piece golf ball.

	<u>Ingredients</u>	<u>% by weight</u>
20	Butadiene rubber	100
	Zinc oxide	20
	Zinc acrylate	30
	Antioxidant	0.5
	Dicumyl peroxide	1.5

### Molding of an ionomer cover

An ionomer resin composition was prepared by mixing from the following ingredients and covered on the core obtained in Example 2 by injection molding at a temperature of 200 to 250 °C to form a two piece golf ball.

<u>Ingredients</u>	<u>% by weight</u>
Ionomer resin *1	100
Titanium dioxide	1

\*1 Available from Mitsui Polychemical Co., Ltd. as Himilane 1706.

In the above three Examples, the following four mold 1 to 4 were used for molding, and their releasability is evaluated, and the results are shown in Table 1.

Mold 1 : This mold was prepared by forming tungsten carbide coating on a mold and is an embodiment of the present invention. The coating had a thickness of 12 μm.

Mold 2 : A fluorine containing releasing agent which is available from DAIKIN INDUSTRIES, LTD. company as DAIFREE ME 413 was diluted 5 to 20 times, and sprayed on a mold which had been heated.

Mold 3 : A fluorine resin which is available from Nippon Fusso Kogyo K.K. company as 006XL (mainly containing tetrafluoro ethylene-hexafluoropropylene copolymer) was applied on a mold and baked.

Mold 4 : A silicone releasing agent which is available from FREKOTE INC company as FREKOTE 33 was spray-coated 2 to 5 times on a mold which had been heated to 50 to 80 °C, and then baked at 200 °C.

Evaluation of releasability is as follow.

Excellent: Releasability is perfect and a molded article was easily taken out by hand .

Good: Releasability is good and a molded article was taken out by hand with twisting.

Fairly good: Releasability is not good and a molded article was taken out by knocking with a mallet.

5 Poor: Releasability is poor and it was impossible to take out a molded article even by knocking with a mallet.

Table 1

	Example	Comparative Examples			
	Mold 1	Mold 2	Mold 3	No coating	Mold 4
Third cycle					
One piece	Excellent	Excellent	Excellent	Poor	Excellent
Two piece	Excellent	Excellent	Excellent	Poor	Excellent
Ionomer	Excellent	Poor	Excellent	Poor	Excellent
20th cycle					
One piece	Excellent	Poor	Good *1	---	Poor
Two piece	Excellent	Good	Fairly good*1	---	Poor
Ionomer	Excellent	---	Fairly good*1	---	Fairly good
One week					
One piece	Excellent	*2	Poor	---	---
Two piece	Excellent	*2	Poor	---	---
Ionomer	Excellent	---	---	---	Poor

\*1 The coating on the contact surface between an upper mold and a lower mold is peeled off.

\*2 The mold has been stained.

CLAIMS:

1. A mold having good releasability comprising a mold body and a tungsten carbide layer in the range of from 2 to 20  $\mu\text{m}$  on the inner surface of the mold body.
2. A mold as claimed in claim 1, being suitable for molding a gold ball.
3. A mold as claimed in claim 1 or claim 2 wherein the mold is made of stainless steel, aluminum or copper.
4. A mold as claimed in any one of claims 1 to 3 wherein the tungsten carbide layer is formed by reacting tungsten fluoride with benzene in a hydrogen gas atmosphere.
5. A mold as claimed in claim 4 wherein the reaction is conducted at a temperature of 350 to 550°C for 0.5 to 2 hours.
6. A mold as claimed in claim 1 substantially as hereinbefore described.
7. A mold substantially as hereinbefore described with reference to the example.

**Relevant Technical Fields**

- (i) UK CI (Ed.N) B5A AF35K  
 (ii) Int CI (Ed.6) B29C (33/58: 33/60)

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASE: WPI

Search Examiner  
 MR J P LEIGHTON

Date of completion of Search  
 17 FEBRUARY 1995

Documents considered relevant  
 following a search in respect of  
 Claims :-  
 1 - 7

**Categories of documents**

- X: Document indicating lack of novelty or of inventive step. P: Document published on or after the declared priority date but before the filing date of the present application.
- Y: Document indicating lack of inventive step if combined with one or more other documents of the same category. E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.
- A: Document indicating technological background and/or state of the art. &: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
X	WPI Abstract Accession No 92-205169/25 and JP 4135808 A (CANNON KK) see abstract 11.5.92	1 at least
X	WPI Abstract Accession No 92-505168/25 and JP 04135807 A (CANNON KK) 11.5.92 see abstract	1 at least
A	WPI Abstract Accession No 88-037183/06 and DE 3625709 (WACHER CHEMIE) 4.2.88 see abstract	

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).